

TERRESTRIAL ISOMAGNETIC LINES FOR SOUTH AFRICA
FOR THE EPOCH JULY 1, 1903.

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(With Four Maps, Plates VIII., IX., X., XI.)

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The terrestrial isomagnetics dealt with in this paper are those of vertical, total, northerly, and westerly intensity. The true isomagnetics for these intensities for the epoch July 1, 1903, have already been given in another place ; * the data given there have been used in preparing the maps for the terrestrial lines, and in so far as they are here required are quoted in the following table :—

TABLE 1.

Mean Station of District.†	ϕ .	λ .	Z.	T.	X.	Y.
I.	33° 46' S.	18° 57' E.	·30669	·35681	·16034	·08727
II.	33 52	20 49	·31266	·36096	·15861	·08573
III.	33 36	23 0	·31845	·36530	·15771	·08347
IV.	33 25	25 1	·32298	·36848	·15775	·08132
V.	31 39	28 32	·32758	·37302	·16117	·07630
VI.	29 43	30 31	·32838	·37510	·16611	·07305
VII.	27 42	30 3	·32008	·37100	·17313	·07213
VIII.	27 57	27 49	·31570	·36736	·17258	·07515
IX.	25 59	30 14	·31572	·36999	·17946	·07065
X.	26 35	27 56	·31252	·36645	·17618	·07429
XI.	29 38	26 12	·31587	·36573	·16698	·07748
XII.	31 38	25 19	·31927	·36696	·16217	·08009
XIII.	31 58	21 31	·30962	·35973	·16255	·08409
XIV.	30 26	22 0	·30608	·35792	·16620	08310
XV.	23 53	29 44	·30722	·36615	·18671	·06947

The above results were next treated by the method first used by Mathias.† The mean station of District XI. was taken as reference

* "Report of a Magnetic Survey of South Africa," by J. C. Beattie, 1909, R.S.L.

† *Loc. cit.*, p. 52.

‡ "Annales de l'Observatoire Astronomique, Magnétique et Météorologique de Toulouse," T. 7. "Recherches sur le Magnétisme terrestre par E. Mathias." Paris, 1907.

point, and a table—No. 2—formed, in which are given the differences in longitude ($\Delta\lambda$), latitude ($\Delta\phi$), vertical intensity (ΔZ), total intensity (ΔT), northerly intensity (ΔX), and westerly intensity (ΔY).

TABLE 2.

Mean Station of District.	$\Delta\lambda$.	$\Delta\phi$.	ΔZ .	ΔT .	ΔX .	ΔY .
I.	-435'	+248'	-918 γ	-892 γ	-664 γ	+979 γ
II.	-323	+252	-321	-577	-837	+825
III.	-192	+238	+258	-43	-927	+599
IV.	-71	+227	+711	+275	-923	+384
V.	+140	+121	+1171	+729	-581	-118
VI.	+259	+5	+1251	+937	-87	-443
VII.	+231	-116	+421	+527	+615	-535
VIII.	+97	-101	-17	+163	+560	-233
IX.	+242	-219	-15	+426	+1248	-683
X.	+104	-183	-335	+72	+920	-319
XII.	-53	+120	+340	+123	-481	+261
XIII.	-281	+140	-625	-600	-443	+661
XIV.	-252	+48	-979	-781	-78	+562
XV.	+212	-345	-865	+42	+1973	-801

With these differences equations of the form—

$$\Delta(\text{mag. elem.}) = a + b\Delta\lambda + c\Delta\phi + d(\Delta\lambda)^2 + e\Delta\lambda\Delta\phi + f(\Delta\phi)^2$$

were obtained, and the values of the constants a , b , c , d , e , and f determined.

The results * for the four elements were as follows :—

$$\begin{aligned}\Delta Z_c &= .39009 + 4.59073\Delta\lambda + 4.86998\Delta\phi - .00106(\Delta\lambda)^2 \\ &\quad - .0013172\Delta\lambda\Delta\phi - .001934(\Delta\phi)^2 \\ \Delta T_c &= .45302 + 3.42021\Delta\lambda + 2.13017\Delta\phi - .0005825(\Delta\lambda)^2 \\ &\quad - .0010793\Delta\lambda\Delta\phi - .0002655(\Delta\phi)^2 \\ \Delta X_c &= .30017 - .27939\Delta\lambda - 4.84872\Delta\phi + .0003224(\Delta\lambda)^2 \\ &\quad - .0020504\Delta\lambda\Delta\phi + .0013477(\Delta\phi)^2 \\ \Delta Y_c &= .66451 - 1.90644\Delta\lambda + .96844\Delta\phi - .0005363(\Delta\lambda)^2 \\ &\quad + .0000609\Delta\lambda\Delta\phi - .0007839(\Delta\phi)^2\end{aligned}$$

From these equations the calculated values Z_c , T_c , X_c , Y_c , were found for the respective mean stations, and the differences between these and

* I have to thank Mr. Whittingdale of the Royal Observatory of the Cape of Good Hope for carrying out the necessary calculations.

the values given in Table 1 obtained. The results are shown in the following table:—

TABLE 3.

Mean Station of District.	$\Delta Z_c - \Delta Z.$	$\Delta T_c - \Delta T.$	$\Delta X_c - \Delta X.$	$\Delta Y_c - \Delta Y.$
I.	+ 2 γ	- 32 γ	- 22 γ	+ 2 γ
II.	- 17	+ 64	+ 22	- 10
III.	- 27	- 50	+ 39	- 4
IV.	+ 24	+ 11	- 23	- 7
V.	+ 30	+ 20	- 24	+ 14
VI.	- 69	- 35	+ 40	- 16
VII.	+ 69	+ 55	+ 3	+ 8
VIII.	- 7	+ 2	- 30	+ 2
IX.	+ 16	- 9	- 31	+ 4
X.	- 91	- 55	+ 56	- 23
XII.	+ 17	- 2	- 23	+ 10
XIII.	- 9	- 27	+ 4	+ 17
XIV.	+ 43	+ 41	- 7	- 7
XV.	+ 18	+ 15	- 4	+ 8

Finally, Table 4 gives the calculated values for the four intensities at the intersections of alternate whole degrees of latitude and of longitude. From these figures the respective terrestrial lines have been plotted as shown in maps 1, 2, 3, 4 (Plates VIII., IX., X., XI.).

TABLE 4.

$\lambda.$	$\phi.$	$Z_c.$	$T_c.$	$X_c.$	$Y_c.$
18° E.	34° S.	·30397	·35428	·16000	·08749
20	34	·31003	·35865	·15869	·08578
22	34	·31595	·36285	·15746	·08391
24	34	·32150	·36689	·15634	·08189
26	34	·32677	·37074	·15530	·07971
18	32	·29829	·35122	·16395	·08674
20	32	·30455	·35574	·16293	·08502
22	32	·31065	·36010	·16201	·08315
24	32	·31639	·36429	·16118	·08111
26	32	·32185	·36831	·16044	·07891
28	32	·32703	·37216	·15979	·07659
18	30	·29205	·34808	·16835	·08577
20	30	·29850	·35276	·16763	·08404
22	30	·30480	·35727	·16700	·08215
24	30	·31072	·36161	·16646	·08012
26	30	·31737	·36579	·16602	·07792
28	30	·32174	·36980	·16567	·07557
30	30	·32681	·37364	·16541	·07307
18	28	·28526	·34486	·17303	·08457
20	28	·29189	·34969	·17260	·08283
22	28	·29838	·35436	·17226	·08093
24	28	·30450	·35886	·17202	·07889

TABLE 4 (*continued*).

λ .	ϕ .	Z_c .	T_c .	X_c .	Y_c .
26° E.	28° S.	·31033	·36319	·17187	·07668
28	28	·31589	·36736	·17181	·07433
30	28	·32115	·37135	·17185	·07182
32	28	·32612	·37518	·17198	·06916
18	26	·27791	·34157	·17815	·08314
20	26	·28473	·34656	·17801	·08140
22	26	·29141	·35138	·17798	·07949
24	26	·29772	·35603	·17803	·07744
26	26	·30374	·36052	·17818	·07522
28	26	·30949	·36484	·17843	·07286
30	26	·31494	·36899	·17876	·07034
32	26	·32010	·37298	·17918	·06767
26	24	·29658	·35777	·18486	·07353
28	24	·30252	·36225	·18540	·07117
30	24	·30816	·36655	·18602	·06864
32	24	·31351	·37069	·18674	·06596
26	22	·28887	·35494	·19193	·07162
28	22	·29500	·35953	·19277	·06924
30	22	·30073	·36404	·19369	·06671
32	22	·30637	·36833	·19470	·06402